REMARKS/ARGUMENTS

The Office Action (1) rejected claims 21-25 under 35 U.S.C. 102(b) as being anticipated by Sajoto (U.S. Patent Publication 2002/0015855); (2) rejected claims 1-3, 6, 9, 12, 15, 16 and 19-25 under U.S.C. 103(a) as being unpatentable over Bosch (U.S. Patent 6,506,254) in view of Sajoto; (3) rejected claims 4 and 26 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Inazawa (U.S. Patent 5,595,627), Miller (U.S. Patent 4,439,463) and Frankel (U.S. Patent 6,019,848); (4) rejected claims 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao (U.S. Patent 5,885,356); (5) rejected claim 8 under 35 U.S.C. 103(a) as being unpatentable over Bosch, Sajoto and Zhao as applied to claim 5 above, and further in view of Freiberger (U.S. Patent 3,880,396); (6) rejected claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao (U.S. Patent 5,968,379); (7) rejected claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Sopory (U.S. Patent 6,492,629); (8) rejected claim 11 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Collins (U.S. Patent 6,063,233); (9) rejected claims 1-3, 6, 9, 12, 15, 16 and 19-25 under 35 U.S.C. 103(a) as being unpatentable over Collins (U.S. patent 6,518,195) in view of Sajoto and Bosch; (10) rejected claims 4 and 26 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Inazawa, Miller and Frankel; (11) rejected claims 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao; (12) rejected claim 8 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, Bosch, and Zhao as applied to claims 5 above, and further in view of Freiberger; (13) rejected claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao; (14) rejected claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Sopory; (15) rejected claim 11 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Collins.

(1) Regarding the rejection of claims 21-25 under 35 U.S.C. 102(b) as being anticipated by Sajoto, applicant has amended the claims to particularly point out the innovative features of the present invention. Specifically, Applicant has amended the claims to provide a limitation of a controller configured to alternate steps of etching and passivating the substrate surface. The controller is further configured to regulate the temperature of the heater liner to a temperature higher (such as higher than 150C) than the condensation temperature of one or more polymers generated by the plasma to reduce the effect of plasma heating on the deposition rate of the one or more polymers on the liner to minimize the change of the substrate etch rate over time.

Applicant submits that there is no new material added, and supports for the present amendment can be found at least in Fig. 2, and paragraphs [0048], [0058] and [0063]. As shown in Fig. 2 and discussed in paragraph [0048], a control device 9e governs the etching flow rate and the passivating flow rate in an alternate manner. Further, in Fig. 2 and paragraphs [0058] and [0063], a control device 19 regulates the temperature of the heater liner.

Applicant submits that the present amended claims are not anticipated by Sajoto since Sajoto fails to disclose at least an element of the present claims, namely a control device configured to alternate etching and passivating.

(2) Regarding the rejection of claims 1-3, 6, 9, 12, 15, 16 and 19-25 under U.S.C. 103(a) as being unpatentable over Bosch in view of Sajoto, Applicant has amended the claims to particularly point out the innovative features of the present invention.

In an embodiment, the present invention discloses an etch reactor for deep silicon etching, comprising a control device configured to execute alternate etching a substrate, comprising alternating steps of etching the substrate by a plasma of an etching gas, and steps of passivating surfaces by a plasma of a passivating gas.

The present invention recognizes that conventional alternate etching process exhibits a gradual degradation of the etch rate, which severely affects the performance of the etch reactor. Thus in an embodiment, the present invention discloses a metal heated liner, heating part of the reactor wall to a temperature higher than a condensation temperature of one or more polymers generated by the plasma to reduce the effect of plasma heating on the deposition rate of the one or more polymers on the liner to minimize the change of the substrate etch rate over time.

Applicant submits that the present invention is patentable in view of Bosch and Sajoto, since these prior art references are silent with respect to an alternate etching process, and particularly, to a heated metal liner to keep the etch rate constant over time.

In addition, Applicant submits that a reactor having a heated metal liner together with a control device regulating the temperature of the heated metal liner offers an unexpected benefit of minimizing the change of the etch rate over time. Applicant hereby submits a declaration showing that the present system is a result of Applicant's own works for more than 2 years in an effort to stabilize the etch rate of the alternate etching process in a plasma etch reactor. Applicant submits that the present process, with over two years of development time, is not at all obvious to persons with ordinary skill in the art.

(3) Regarding the rejection of claims 4 and 26 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Wang, Inazawa, Miller and Frankel, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(4) Regarding the rejection of claims 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(5) Regarding the rejection of claim 8 under 35 U.S.C. 103(a) as being unpatentable over Bosch, Sajoto and Zhao as applied to claim 5 above, and further in view of Freiberger, Applicant submits that this is a dependent claim, and thus should be patentable at least by the reasons stated by the independent claim.

(6) Regarding the rejection of claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao (U.S. Patent 5,968,379), Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(7) Regarding the rejection of claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Sopory, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(8) Regarding the rejection of claim 11 under 35 U.S.C. 103(a) as being unpatentable over Bosch and Sajoto as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Collins (U.S. Patent 6,063,233), Applicant submits that this is a dependent claim, and thus should be patentable at least by the reasons stated by the independent claim.

(9) Regarding the rejection of claims 1-3, 6, 9, 12, 15, 16 and 19-25 under 35 U.S.C. 103(a) as being unpatentable over Collins (U.S. patent 6,518,195) in view of Sajoto and Bosch, Applicant has amended the claims to particularly point out the innovative features of the present invention.

Similar to the above discussion with respect to the prior arts of Bosch and Sajoto, Applicant submits that Collins, Bosch and Sajoto all fail to disclose an alternate etching process, and particularly, to a heated metal liner to keep the etch rate constant over time.

In addition, Applicant submits that the present invention is not at all obvious in view of the cited prior arts, since it offers an unexpected benefit of stabilizing the etch rate of an alternate etching process.

(10) Regarding the rejection of claims 4 and 26 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Inazawa, Miller and Frankel, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(11) Regarding the rejection of claims 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(12) Regarding the rejection of claim 8 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, Bosch, and Zhao as applied to claims 5 above, and further in view of Freiberger, Applicant submits that this is a dependent claim, and thus should be patentable at least by the reasons stated by the independent claim.

(13) Regarding the rejection of claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Zhao, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(14) Regarding the rejection of claims 10 and 13 under 35 U.S.C. 103(a) as being unpatentable

over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Sopory, Applicant submits that these are dependent claims, and thus should be patentable at least by the reasons stated by the independent claim.

(15) Regarding the rejection of claim 11 under 35 U.S.C. 103(a) as being unpatentable over Collins, Sajoto, and Bosch as applied to claims 1-3, 6, 9, 12, 15, 16 and 19-25 above, and further in view of Collins, Applicant submits that this is a dependent claim, and thus should be patentable at least by the reasons stated by the independent claim.

Conclusion

In light of the above, it is respectfully requested that all outstanding rejections be reconsidered and withdrawn. The Examiner is respectfully requested to telephone the undersigned if he can assist in any way in expediting issuance of a patent.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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